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AVS 59
Oct. 28-Nov. 2, 2012

UK's Premier Vacuum & Nano Technologies Exhibition & Conference
Wed 17 & Thurs 18 October Ricoh Arena Coventry
VACUUM EXPO

Symposium Highlights

Researchers Make Progress toward Improving Breast Cancer Treatment with Ultrasound-Guided Surgery

Wednesday, October 31, 2:40 p.m., Convention Center Room 23

Article: **"Integrated processing of contrast pulse sequencing ultrasound imaging for enhanced active contrast of hollow gas filled silica nanoshells and microshells," Journal of Vacuum Science & Technology B , Volume 30 , Issue 2, Special Issue: Nanoscience in Cancer Research.**

When surgeons operate to remove a tumor, determining exactly where to cut can be tricky. Ideally, the entire tumor should be removed while leaving a continuous layer of healthy tissue, but current techniques for locating the tumors during surgery are imprecise. Now a multidisciplinary team from the University of California, San Diego, is developing an alternate means of precisely tagging breast cancer tumors for removal or targeted destruction. They will present the results of their investigations at the AVS 59th International Symposium and Exhibition.

Breast cancer is the most common female cancer in the U.S., and the main cause of death in women ages 40-59, according to UptoDate, an information service for clinical physicians. Over a lifetime, 1 in 8 women in the U.S. is expected to develop breast cancer. Despite great strides in survival, there is trauma associated not only with the disease, but also with its treatment. Many women want to avoid a full mastectomy, but conventional breast-conserving approaches, such as lumpectomy, can be arduous. Up to 25 percent of lumpectomies require a second surgery to excise the entire tumor.

The UCSD team is working on a better method for tagging tumors that should reduce the need for follow-up surgeries. The researchers developed iron-doped - and therefore biodegradable - silica micro/nano spheres for implanting into the body as ultrasound contrast markers to guide a surgeon using ultrasound during breast lumpectomy. Additionally, the particles can also be used to destroy tumor tissue with high intensity focused ultrasound (HIFU) ablative therapy, an approach used elsewhere in the world to treat prostate cancer and used in the U.S. to treat uterine fibroids.

If breast tumors are precisely marked, the number of second surgeries can be decreased by 50 percent, according to published studies using radiative tumor markers. Because the gas-filled nanoparticles that the researchers developed make tumors easier to see, they hold the potential for increasing surgical precision with a safe agent. Once injected into the breast cancer tumor, they stick, rendering the tumor more visible with contrast-enhanced ultrasound.

"We are trying to improve the markers surgeons use so they can pull the tumors out with more precision and ease, while reducing trauma for the patient," explains Alex Liberman, the PhD graduate student in the materials science and engineering program who has taken the

Tampa, FL
Website

68th IUVSTA Workshop
December 9-13, 2012
Hong Kong
Website

SCiMAN 7
December 10-11, 2012
San Pedro, Montes de Oca, Costa Rica
Website

PCSI-40 2013
January 20-24, 2013
Waikoloa, HI
Website

ICMCTF
April 29-May 2, 2013
San Diego, CA
Website

Event Calendar

Upcoming Board Meetings

2012
October 28, 2012
Tampa, Florida

2013
January 27, 2013
Research Triangle Park, North Carolina

April 28, 2013
San Diego, California

July 22, 2013
New York, New York

October 27, 2013
Long Beach, California

concept from test tube to animal models. Adds his advisor, chemical physicist Andrew Kummel, PhD. "We are using these particles for two applications. In the short term we are injecting them into breast tumors to enable surgeons to halve the number of second surgeries by readily locating the tumors in the operating room with low- power ultrasound imaging. In the long term, we want to inject the particles intravenously, have them stick to the tumors, and then ablate the tumors by blowing up the particles with high intensity focus ultrasound which is called HIFU."

As now performed, the lumpectomy requires a surgeon to extract tumors through incisions in the breast with the aid of guide wires that protrude out of the breast to help locate the tumor. The wires are prone to movement, and therefore yield imprecise results. Furthermore, the wires are inserted while the patient is awake, which is unpleasant for the patient.
The next step for the team involves conducting more animal tumor studies. Those results will determine if the particles are suitable technology to submit to human clinical breast cancer trials as a localizing agent to guide lumpectomy surgery or even for HIFU therapy.

Scientists Use Molecular Layers to Study Nanoscale Heat Transfer

Monday, October 29, 5:00 p.m., Convention Center Room 22

Scientific research has provided us with a fundamental understanding of how light (via photons) and electricity (via electrons) move within and between materials at the micrometer or nanometer levels, making possible a wide variety of miniature devices such as transistors, optical sensors and microelectromechanical systems (MEMS). However, man's knowledge of micro- and nanoscale heat flow is rudimentary at best. Now, a research team at the University of Illinois at Urbana-Champaign (UIUC) has developed a novel system for examining and measuring nanoscale thermal conductance at the interface between two materials. With further refinement, the scientists believe their advance may one day provide data for applications such as harvesting electricity from waste heat, better cooling of microelectronic devices and "heat-seeking" targeting of disease cells by hyperthermal (above normal body temperature) therapeutics.

The team's findings will be presented by Mark Losego, formerly a post-doctoral fellow at UIUC and now a research assistant professor in chemical and biomolecular engineering at North Carolina State University, during the AVS 59th International Symposium & Exhibition.

At the nanoscale, thermal properties are the result of vibrations between neighboring atoms. Bonds between atoms carry these vibrations similar to an oscillating spring. The UIUC team developed a technique for studying the effects of these bonds on heat transport across an interface between two different materials. "We wanted a system where we could observe, analyze and quantify thermal flow across an interface with atomic-level precision," Losego says.

The system starts with a substrate base of quartz crystal, upon which the researchers place molecular chains that are 12 carbon atoms long. At the base of each chain is a chemical "cap" that covalently bonds to quartz. The attraction of these caps to the substrate spontaneously aligns all of the carbon chains into an ordered array of molecules known as a self-assembled monolayer (SAM). At the opposite end of each carbon chain is a different kind of cap, either a thiol (sulfur and hydrogen) group that bonds strongly to metals or a methyl group (carbon and hydrogen) that bonds weakly.

"We then make use of a viscoelastic silicone stamp to 'transfer print' gold layers onto the SAM surface," Losego explains. "This process is similar to transferring a decal onto a T-shirt where the gold film is the 'decal' attached to the silicone stamp 'backing'. When we slowly peel away the silicone, we leave the gold layer on top of the SAM."

It is at the interface between the gold film and the SAM, Losego says, where nanoscale heat flow is characterized. "Changing the chemical groups that are in contact with the gold layer allows us to see how different bonds affect heat transfer," he adds.

Combined with an ultrafast laser technique capable of monitoring temperature decay (or heat loss) with picosecond (trillionth of a second) resolution, the UIUC researchers are able to use their experimental system to evaluate heat flow at the atomic scale. "We heat the gold layer attached to the monolayer and can monitor temperature decay with time," Losego explains. "Concurrently, we observe oscillations in the gold film that indicate the strength of the bonds at the gold-SAM junction. Using these measurements we are able to independently verify that strong bonds [fast-decaying oscillations] have rapid heat transfer while weak bonds [slowly decaying oscillations] have slower heat transfer."

The researchers plan to refine their nanoscale thermal measurement system and develop

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theoretical calculations to better interpret the data it produces.

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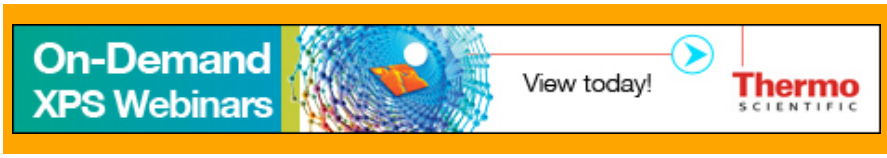

Membership Highlights

AVS Excellence in Leadership Recognition Call for Nominations

The AVS Membership Committee has created a new recognition for Excellence in Leadership. The AVS seeks to recognize individuals who not only excel in science and/or engineering, but who also, through mentoring, have enhanced the careers of future generations who might not otherwise have considered or had access to opportunities in science, engineering, and technology. Their leadership in the effort to develop fully the world's human resources is critical to the best scientific and engineering progress.

Recipients of this honor will have their profile displayed on the AVS Website, featured in this Newsletter and will receive a certificate of recognition. It is anticipated that such recognitions will be made periodically throughout the year. See Eligibility & Nominations criteria at the end of this article.

Eligibility & Nominations for Recognition in Excellence in Leadership
Nominations from AVS members, including self-nominations, for this honor are welcome and should include the following items on one page: (1) Nominator's Name, Affiliation, E-mail, (2) Nominee's Name, Affiliation, E-mail, website/s, (3) a high-resolution photograph of the nominee in a science/engineering setting, (4) a short paragraph describing the nominee's scientific/engineering accomplishments in an area relevant to the AVS, (5) an additional paragraph describing their outstanding mentoring and effective guidance to a significant number of persons who might not otherwise have considered or had access to opportunities in science, engineering and technology (including persons with disabilities, women and minorities) and who are students at the K-12, undergraduate, or graduate education level, or early career scientists or engineers who have recently completed their degrees (this includes post-doctoral fellows, assistant professors and individuals in the private sector) and (6) a short biography of the nominee. The nominee does not need to be an AVS member. Nomination packages should be sent to **bridget_rogers@avs.org.**

Nominations will be accepted on a rolling basis and will be considered for up to one year from the date of receipt. In most cases, only acknowledgement of the receipt of nominations will be made. Additional information or supporting material and letters for the top candidates may be requested.

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Nothing Matters

AIP Announces Free Journal Content in Celebration of Nobel Physics

To recognize the winners of the 2012 Nobel Prize in Physics, which were announced October 9, and to celebrate the achievements of the global physics community, AIP Publishing has made all journal content open to the public during October 2012. This month everyone has free online access to all AIP journals and Conference Proceedings as far back as 1999!

Readers can use this opportunity to get more out of the JCP Spotlight Collections "Perspectives" articles by enjoying free access to the highlighted references, or to get an overview of the hottest research trends in different fields by reading review articles-a great resource for people looking for a comprehensive view of a specific topic. Readers are encouraged to explore each of the AIP journal sites this month, but the links below will get you started.

- **JCP Spotlight Collections: Most Recent "Perspectives" Article**
- **Physics of Plasmas Review Articles**

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Conference Report

The 3rd International Workshop on Nanoscale Imaging for Energy Applications

September 11-13, 2012
Oak Ridge National Laboratory, Center for Nanophase Materials Sciences
Oakridge, Tennessee

By An-Ping Li, Oak Ridge National Laboratory

The workshop took place in Oak Ridge, September 11-13, 2012, sponsored by Center for Nanophase materials Sciences at ORNL, FIRST Center at ORNL, AVS Tennessee Valley Chapter, and Chemical Sciences Division at ORNL. The Workshop featured 35 oral and 29 poster presentations, with 115 registered attendees. Meeting brochure: **http://cnms.ornl.gov/workshops/2012/Nanoscale_Imaging_Workshop_Booklet.pdf**

Participants have discussed the recent advances in characterization of energy relevant materials systems using Scanning Probe Microscopy (SPM) techniques, as well as the state of the art in energy dissipation and transformation measurements by SPM. Featured presentations include a plenary talk from Z.L. Wang, Georgia Institute of Technology on "Nanopiezotronics and Nanowire Based Energy Harvesting;" invited talks from M. Hersam from Northwestern University on "Scanning Probe Microscopy of Energy Materials," and V. Sethuraman from Brown University on "Strain Dynamics in Energy Materials."

A wide variety of topics have been covered, such as mapping of carrier dynamics and photo-induced behavior of photovoltaic materials, ionic and electronic transport in fuel cells and Li-ion batteries, energy harvesting, and energy dissipation imaging by multiple resonant and band excitation SPMs, as well material characterization using mass spectrometry combined with SPM and optical spectroscopies for multimodal imaging. Eight industrial vendors and manufacturers have showcased their recent development on SPM technology and instrumentations.

To encourage the participation from graduate students and young scientists, the workshop has awarded 13 graduate student fellowships to reimburse the registration fee and lodging at the conference hotel. In the poster session on Tuesday, Rebecca Agapov from The University of Akron and Nataly Chen from University of Washington won poster awards.

A business meeting of an ad-hoc group of AVS members was held Thursday evening following technical sessions. The purpose of the meeting was to continue efforts to re-establish the AVS Tennessee Valley Chapter. A discussion was held that centered on two main topic: (1) what next step should be taken to create an active chapter and (2) once established, what activities would this chapter initiate.

A motion was made to establish a new Executive Board, seconded and passed. Nominations for the Executive Board were made and a motion was presented to accept those nominated (seconded and passed). Selected to serve on the Executive Board included: H. Meyer (Chair, ORNL); D. Mullins (Treasurer, ORNL); B. Rogers (Nashville area); S. Gupta (Alabama Area), M. Williams (Atlanta Area), J. Wedelken (ORNL), A.P. Li (ORNL). A meeting of the newly formed Executive Board will be held prior to the AVS International Symposium. This meeting will take place using conference call and or "GoToMeeting". Suggestions from the AVS Hudson-Mohawk Chapter were discussed regarding local meeting formats. No final decisions were made with regard to meeting formats. It is anticipated that local events may be planned by the future Board in different geographic areas which are appropriate to the local member base in each area. A final topic of discussion was a desire for the TVC-AVS to continue to support the AVS International Symposium by sending regional high school teachers to the Science Educators Workshop.

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